SCIENCE:

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Espy's Experiments.

PROFESSOR FERREL'S letter in *Science* of Oct. 3 emphasizes some of the points that I have insisted upon in regard to the distinction which should be made between meteorologic facts and theories. Professor Ferrel clearly sets forth the fact that such theories depend upon "physical constants," such as "the mechanical equivalent of a unit of heat, the specific heat of air, the latent heat of aqueous vapor, the tension of the aqueous vapor of saturated air at any given temperature," etc. I have tried to show that starting from such facts, and elaborating a theory which shall account for such complex motions as we meet with in our storms, is certainly very interesting; we do not agree, however, as to whether it is profitable or not. That the results of Espy's experiments do not enter into modern theories will be a surprise to some, I think. I have tried to show that no one, so far as I knew, had tried Espy's experiments or shown that they could be applied to storm conditions as they are now familiar to us. Of course, a score of physicists, more or less, have theorized upon the subject.

May I suggest that I have never contended that latent heat is not set free on condensation of moisture? My whole effort has been to determine the sufficiency of Espy's experiments in establishing the view that there is an uprush of air in our storms, which is increased by the liberation of latent heat from condensation, etc. It seems to me that if all other views regarding his researches prove faulty, the single fact that he used an expansion which was equivalent at times to a rush of air at ten thousand feet per second,—an absolutely incredible velocity for our uprushes,—would be well-nigh fatal to his deductions. In repeating Espy's work, I simply attempted to carry on a research which should in some measure be comparable with natural phenomena. Expansions at the rate of five hundred and a thousand feet per second are certainly far greater than any that we can consider as occurring in our storms. I hope shortly to repeat my experiments with improved apparatus, and determine, if possible, a few points in Espy's work that are not quite plain. Professor Ferrel himself shows that these very researches of Espy were faulty, and this corroborates in some measure my results.

Finally, Professor Ferrel calls attention to the deduction that I have made, that compressing air ten inches, without the loss of heat, would heat it 163°, and gives 43° as the true temperature. My deduction was based upon the facts presented by Professor Tyndall on the sixty-sixth page of "Heat as a Mode of Motion." I find I have mistaken Tyndall's meaning. This computation does not seem very simple. One of my friends, a physicist, gives me a very different value from Professor Ferrel's. The simplest computation would be in the case of a cooling after a compression, and after the compressed air has attained the outside temperature. I feel sure, that, if Professor Ferrel will make that computation, he will see at once that his temperature of 45° cannot be correct. The problem seems quite complex, and I would be very glad to have some one familiar with such problems work out a solution. The problem is this: What will be the rise in temperature in a mass of air at atmospheric pressure if its pressure is increased without the loss of any heat: the increase of ten inches to be considered after the air has cooled to its initial temperature? May I call Professor Ferrel's attention to a single point which he seems to have overlooked, or regarded of little importance? It is this: if we consider that Espy, after compressing the air, waited until it attained the outside temperature before explosion, the resultant cooling after expansion cannot be compared in any way directly with the heating produced by compression and without the loss of heat. Moreover, it is impossible to determine, by Espy's work, the amount of the previous heating, from the cooling after explosion.

H. A. HAZEN.

Washington, Oct. 4.

Deaf-Mutes and their Instruction.

BY a deaf-mute is understood one who is born deaf, or lost his hearing before the acquisition of speech, and in consequence thereof is mute. Deafness may be divided into two classes; viz., congenital and acquired. Acquired deafness admits of four subdivisions:—

A. Where hearing has been lost before the acquisition of speech.

B. Where vowel hearing alone is retained.

C. Where the hearing has been lost after the acquisition of speech, but the latter imperfectly retained.

D. Where the hearing has been lost and speech retained, but the individual lacking education, and precluded from training in common with hearing children.

Those described under *C* and *D* are designated as "semi-mutes." Over fifty per cent of the total number of deaf-mutes are of the acquired form. Children who lose their hearing at the age of three or four years are apt to forget speech within about a year's time, unless intelligent parents endeavor to retain and cultivate it. The hearing is more essential to intellectual development and enjoyment than any other sense. Without education, a deaf-mute is entirely debarred from the acquisition of spoken language, the noblest product of the mind. It is true, necessity, the mother of invention, impels one thus affected to invent a language of natural signs to communicate with his fellow-beings; but he is not enabled to express or receive abstract ideas through this medium.